

BET 04P0501

INTERNATIONAL PATENT APPLICATION PCT/FR 2004001629
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OBSERVATIONS IN RESPONSE
TO THE WRITTEN OPINION OF 6 DECEMBER 2004

The Applicant has taken cognizance of the written opinion dated 6 December 2004. In response, it is filing a new set of claims according to the copy appended hereto and makes the following observations.

1. Amendment of the set of claims

1.1 Claim 5 has been amended by omitting the expression "the compensation means comprise an" in order to make it clear that the operational amplifier as defined in Claim 1 is capable of compensating for the trip threshold voltage of at least one modulator and in particular of all of the modulators, as is defined in Claim 5.

1.2 Claim 10 has been amended in order to specify that the modulator includes a gate electrode, a drain electrode and a source electrode. This addition is supported by the application on page 17, lines 8 and 9.

1.3 A Claim 11 has been added to the set of claims. This addition is supported by the description on page 3, lines 6 to 13.

2. Clarity of the set of claims

2.1 According to the Examination Division, it is not possible to recreate the circuit by means of the technical features set out in Claim 1.

However, Article 6 PCT does not require that the features of Claim 1 define the invention in a manner sufficiently complete for it to be able to be carried out. This requirement relates only to the description. In fact, the description of the application is sufficiently complete in order for the circuit to be recreated, as the Examiner has moreover stated, on page 9, line 32 to page 11, line 17.

Article 6 PCT is interpreted as stipulating that Claim 1 specify the essential features that are needed for defining the invention. Now, these essential features comprise only a modulator and an operational amplifier that are designed, especially by a feedback mechanism, to compensate for the trip threshold voltage of the modulator.

The control switches I_1 and I_2 and the row select means, which are defined in Claims 2 to 4, perform the function of switching the emitter between an off state and an on state. Now, this switching may be carried out by other technical means, such as for example by a differential comparator as described in document D1.

Consequently, according to the Applicant, the technical features defined in Claims 2 to 4 are not essential and therefore do not have to be incorporated into Claim 1.

2.2 On line 13 of Claim 1, it is stipulated that a data voltage is applied to the gate electrode of the modulators. This technical feature is described on page 11, lines 20 to 22 and on page 13, lines 34 and 35, and can be seen in Figures 3, 4 and 5 of the application. Claim 1 therefore does not include an error.

2.3 The drain electrode of the modulator is defined on page 17, line 9 and on page 19, line 7 of the new set of claims.

3. Novelty of the subject-matter of Claim 10

3.1 Document D1 (US 2002/047817), which is considered as being the closest prior art of the subject-matter of Claim 10, discloses a circuit for controlling a current modulator T2 having an undefined threshold voltage and at least one operational amplifier 16 connected to the gate electrode of the modulator T2.

3.2 The Applicant shares the opinion of the Examination Division whereby document D1 does not disclose:

a) that the operational amplifier 16 is connected to the source electrode of the modulator and that the feedback of this amplifier compensates for the threshold voltage of the modulator T2 in such a way that the intensity of the drain current that flows through the modulator T2 is independent of the trip threshold voltage of the modulator.

Contrary to the Examiner's opinion, the Applicant considers that document D1 does not disclose:

b) compensation means for compensating for the trip threshold voltage of the modulator T2. This is because it is explicitly described in paragraphs 3 and 5 of document D1 that the control circuit does not include compensation means.

In addition, according to the Applicant,

c) the operational amplifier 16 does not constitute a compensation means for compensating for the trip threshold voltage. This is because the operational amplifier 16 is used as a differential comparator in order to programme the switch time for switching between an on (illuminated) state and an off state of the emitter 14. The operational amplifier 16 is capable of comparing the voltage between its inverting input V_- and its non-inverting input V_+ and of generating either an on (illumination) signal LO or an off signal HI of the emitter 14 depending on the potential difference between its non-inverting input V_+ and its inverting input V_- (paragraph 15).

This comparison function for comparison between two input signals is different from a compensation function for compensation between an output signal and an input signal.

4. Inventive step of the subject-matter of Claim 10

4.1 According to the Applicant, the objective problem to be solved with regard to document D1 is how to compensate for the trip threshold voltage.

4.2 No solution to this problem is suggested in document D1 since that document specifically seeks not to perform this compensation (paragraphs 3 and 5).

4.3 The Examination Division suggests that the objective problem is how to allow high-frequency switching in real time. However, this objective problem and its solution rely on no document of the prior art.

4.4 Furthermore, even if, as the Examination Division suggests, the objective problem is considered to be how to allow high-frequency switching in real time, such a switching function is already performed in document D1 by applying a time-variable reference voltage V_{DRV} to the non-inverting input V_+ of the operational amplifier 16. As this function is already performed in document D1, the Applicant considers that it is unnecessary to modify the circuit described in D1 in order to perform this function.

Even if a person skilled in the art were to modify the circuit of D1 in order to perform this switching function, he would connect a switch I1 between the gate of the modulator T2 and the output of the amplifier 16 and would not obtain the subject-matter of the present invention, which consists in connecting the source electrode of the modulator to the inverting input V₋ of the operational amplifier.

4.5 Document D2 (EP 1 005 013) discloses a display formed from an active matrix and organic emitters. The address circuit (Figures 4 and 7) of each emitter includes, in particular, compensation means for compensating for the trip threshold voltage of the modulator of the circuit.

However, the compensation means described in that document do not in any way comprise an operational amplifier as claimed in Claim 10 of the application (feature c)). This is because the compensation means are formed from additional field-effect transistors designed to modify the signal delivered to the emitters (paragraphs 15, 32, 33). As a variant, the compensation means comprise a calculating device suitable for measuring and recording, periodically, the characteristics of each address circuit and for adjusting the signal delivered to the emitters according to the premeasured characteristics (paragraph 15).

In addition, document D2 neither discloses nor suggests connecting the source of the modulator to the inverting input of the operational amplifier (feature a)) since, on the contrary, it strongly recommends the use of field-effect transistors or of a calculating device.

Consequently, documents D1 and D2 taken in combination in no way suggest the use of an operational amplifier to compensate for the trip threshold voltages of the modulators connecting the source of the modulator to the inverting input of the operational amplifier (features a) and c)).

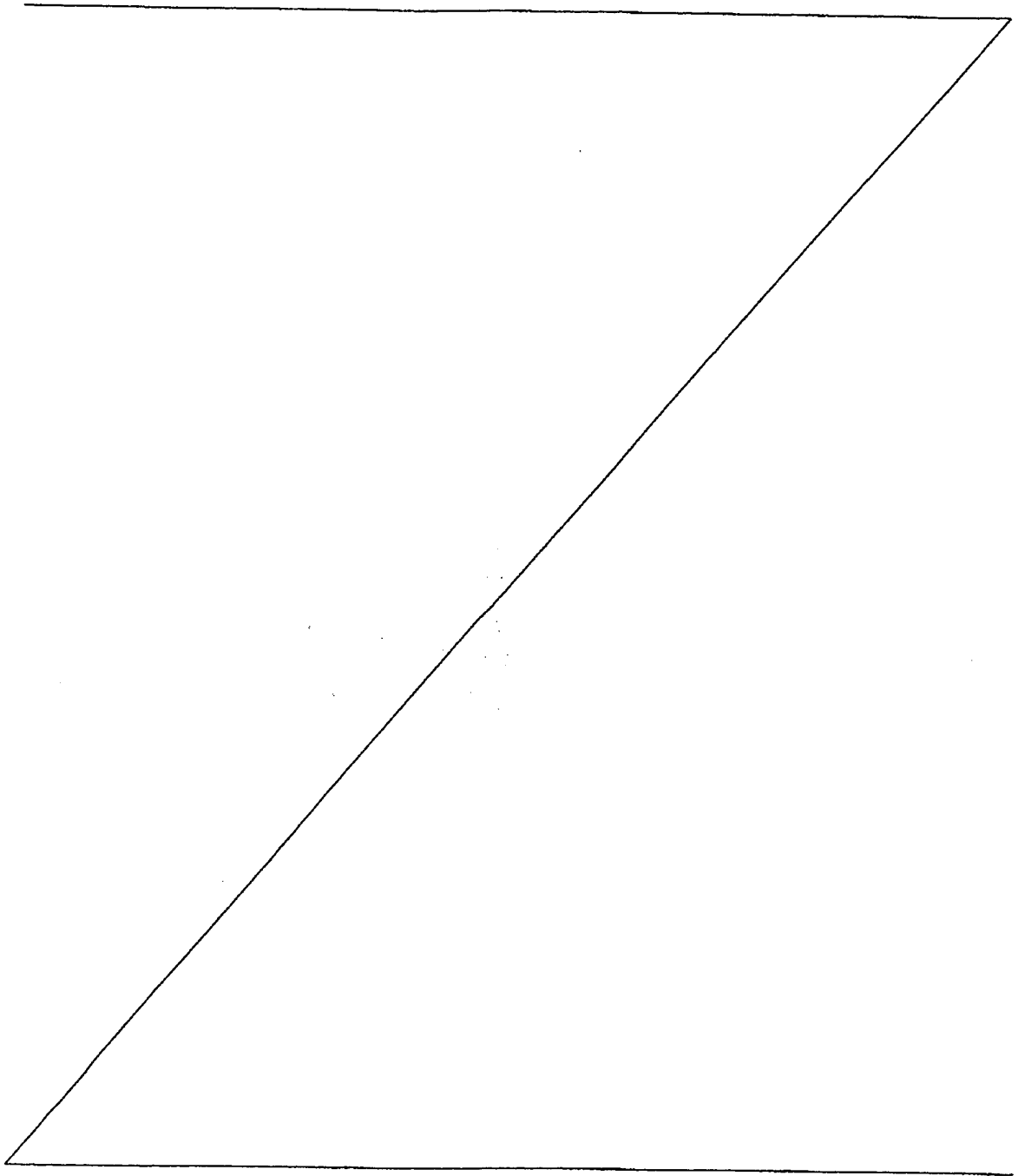
The Applicant therefore considers that Claim 10 of the application defines a subject-matter that involves an inventive step.

Claim 1 incorporates all of the features of Claim 10.

Consequently, Claim 1 of the application defines a subject-matter that also involves an inventive step.

As for Claims 2 to 9, which depend on Claim 1, these also involve an inventive step.

Consequently, the Applicant requests that the patent be granted.

CLAIMS

2. Image display device according to Claim 1,
characterized in that the control means comprise, for the said
5 modulator associated with an emitter, at least a first control switch
(11) connected between the output of the operational amplifier (A_{in} ,
11, 21) and the gate electrode of the said modulator (M_{in}), the first

switch having a gate electrode capable of receiving the row select voltage ($V_{\text{select},n}$) for this emitter (E_{in}).

3. Image display device according to Claim 2, characterized in that the control means comprise, for the said modulator associated with an emitter, a second control switch (I2) connected between the inverting terminal (-) of the operational amplifier ($A_{in, 11, 21}$) and the source electrode of the modulator (M), the second switch (I2) having a gate electrode connected to the gate electrode of the said first switch (I1) in order to receive, synchronously, the select voltage (V_{select}).

4. Image display device according to either of Claims 2 and 3, characterized in that the row select means are capable of supplying a gate electrode of at least one of the said first switches in order to select at least one emitter (E_{in}) in this row.

5. Image display device according to any one of the preceding claims, characterized in that the operational amplifier ($A_{in,11,21}$) is capable of compensating for the trip threshold voltage (V_{th}) of all of the modulators (M_{in}, M_{im}) controlling the emitters (E_{in}, E_{im}) of a column.

omitted: the compensation means comprise an

6. Image display device according to any one of Claims 3 to 5, characterized in that the modulators (M_{in}) and the first (I1) and second (I2) control switches are components fabricated in thin-film polysilicon or thin-film amorphous silicon.

7. Image display device according to any one of the preceding claims, characterized in that the modulators (M_{in}) are n-type transistors and in that their drain is supplied by a supply means (V_{dd}).

8. Image display device according to any one of Claims 1 to 6, characterized in that the modulators (M_{in}) are p-type transistors and in that the control means furthermore include a passive component (R) placed between the source and a supply electrode (V_{dd}) of the modulator (M_{in}).

9. Image display device according to any one of the preceding claims, characterized in that each emitter (E) is an organic light-emitting diode.

5 10. Circuit for controlling a current modulator (M) having a source electrode, a drain electrode, a gate electrode and an undefined trip threshold voltage (V_{th}), the circuit including trip threshold voltage compensation means,

10 characterized in that the trip threshold voltage compensation means comprise at least one operational amplifier (11,21), the output of which is connected to the gate electrode of the said modulator and the inverting input (-) of which is connected to the source electrode of the said modulator, and the feedback of which compensates for the trip threshold voltage of the modulator so that the intensity of the drain current flowing through the
15 modulator (M) is independent of the trip threshold voltage (V_{th}) of the modulator (M).

20 11. Circuit according to Claim 10, characterized in that it includes a storage capacitor (C) connected to the gate electrode of the modulator and capable of storing the voltage applied to the gate electrode of the modulator.